



NATIONAL INSTITUTE FOR ROCKET PROPULSION SYSTEMS

# NIRPS: An Overview

JANNAF

May 2, 2013

Dale Thomas, Ph.D, P.E.  
Associate Director, Technical  
Marshall Space Flight Center



# NIRPS: Where we started

- Sept 16, 2011 letter signed by NASA Administrator Bolden authorized creation of NIRPS
- Letter recommended three focus areas
- Established MSFC as NASA lead, in cooperation with Department of the Air Force and the National Reconnaissance Office

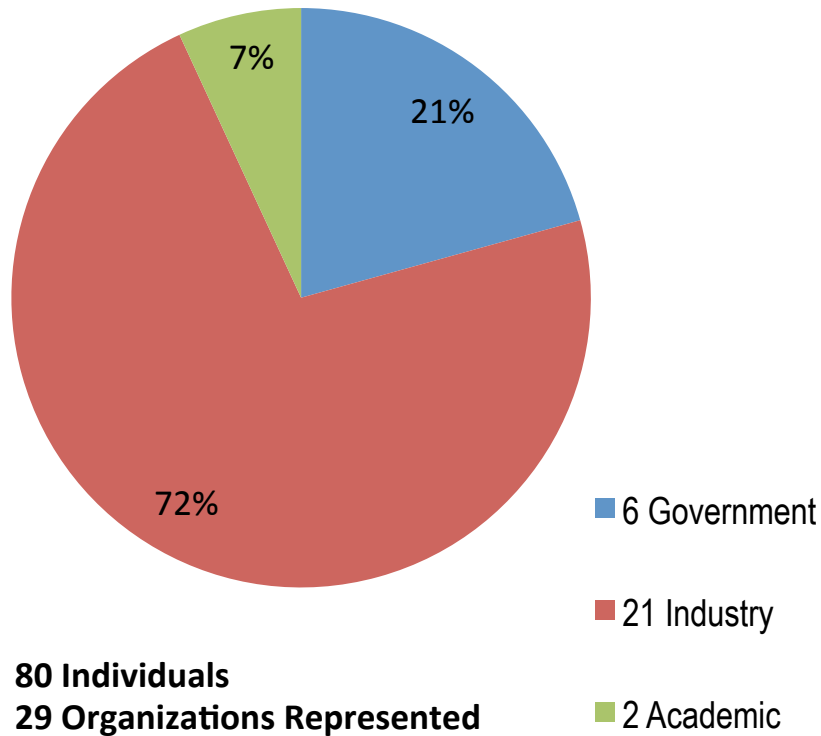


# Building the Foundation

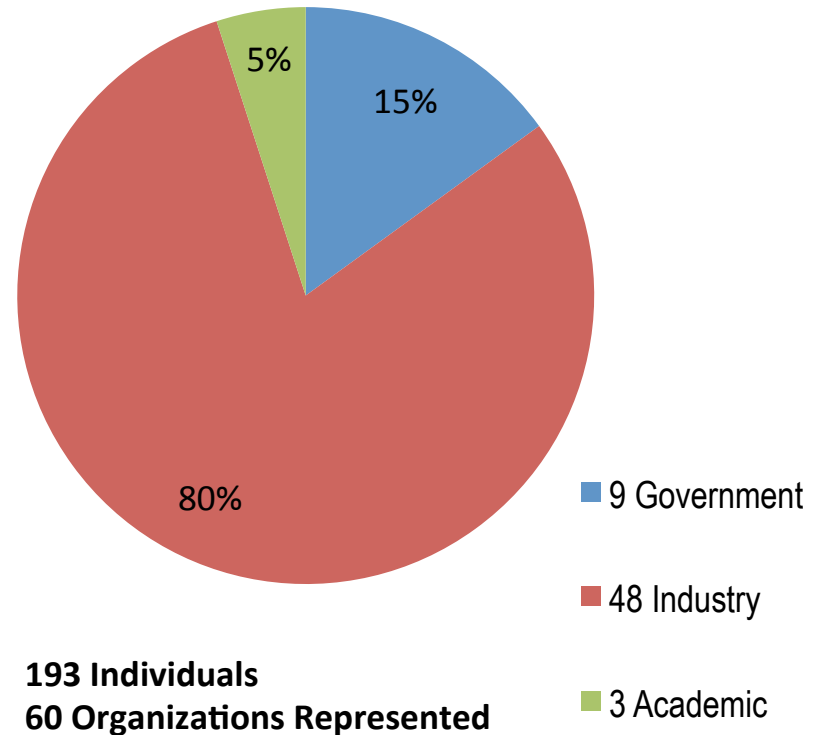
- Identified key concerns of the propulsion community
- Developed and verified Grand Challenges & allocated primary/secondary responsibilities to NIRPS Strategy Teams
- Established NIRPS Strategy Teams with broad membership
- Developed strategies to meet Grand Challenges
- Established monthly NIRPS Planning Team meeting with government, industry, and academic participation
- Executing High Priority Tasks
  - SLS propulsion supply chain analysis
  - Collaborative Portal and Skills and Capabilities Database
  - Integrated Propulsion Technology Roadmaps
- Forums Supported: Von Braun Symposium, Space Transportation Policy Workshop, JANNAF Plenary Session, National Defense Industrial Association, Space Trans. Assoc. Breakfast, JPC, SMDC, Marshall Association
- Held JANNAF/NIRPS Annual Workshop

# NIRPS: Building a National Capability

**November 2011**



**April 2013**

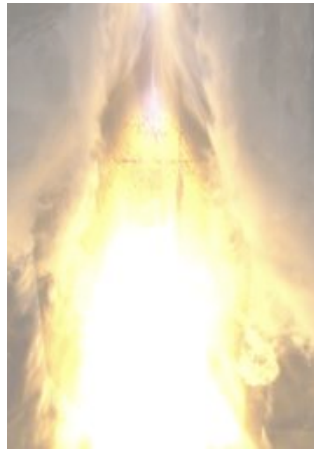


# NIRPS: An Enabler for America's Space Efforts

## Academic Partners



## Commercial Space



## U.S. Government



NASA



FAA



DOD

# NIRPS

**Fostering...**

**a vibrant rocket propulsion community  
that provides reliable and affordable propulsion systems  
in support of the nation's defense, civil and commercial needs.**

# Derivation of the Grand Challenges



# Accomplishments Addressing the Grand Challenges

▣

## Support competitiveness of IB

- *Analyzing data from industry and government to develop a snapshot of U.S. rocket propulsion industrial base health*
- *Developing supply chain analysis methods to support SLS architecture decisions and determine effects of decisions on industrial base*

## Invigorate STEM Pipeline

- *Supported continued development and university utilization of the MSFC Generalized Fluid System Simulation Program (GFSSP)*
- *Planning academic workshop to solicit inputs from academic community on NIRPS activities and strategic plan*

## Develop integrated S&T plan

- *Leading inter-agency task team responding to NDAA 2011 Sec. 1095 action to develop national rocket propulsion strategy*
- *NIRPS and AFRL working to integrate NASA roadmaps with IHP RPT roadmaps*

## Reduce development and sustainment costs

- *Supported NASA/DoD ammonium perchlorate collaborative procurement*

## Collaborate across agencies

- *Initiated cross-community skills, capabilities, and subject matter expert directory, and web tool*
- *Acquired CPIAC Support for Skills & Capabilities directory/web tool*
- *Supported negotiations with USAF on AUSEP & AKE collaboration*
- *Performed additional study requested by OSTP on national altitude test capability*

## Foster access across IB

- *Developing strategies for easier access to US government facilities & expertise in partnership with Defense Acquisition University*

# Support Competitiveness of Industrial Base

## Industrial Base Health Metrics

- Objective: develop useful metrics that can serve as indicators of the the overall health of the Propulsion Industrial Base
- Developed survey to collect data for Industrial Base Health Metrics
  - Released: 22 October 2012
  - Input Deadline: 22 January 2013
- Input from a variety of organizations
  - Integrators
  - Propulsion Suppliers
  - Component and material suppliers
  - US Government Organizations
- Data is currently being analyzed, will be published as an AIAA paper, Fall 2013
- Will be compared with Department of Commerce data for validation

# Support Competitiveness of Industrial Base

## SLS Supply Chain Analysis

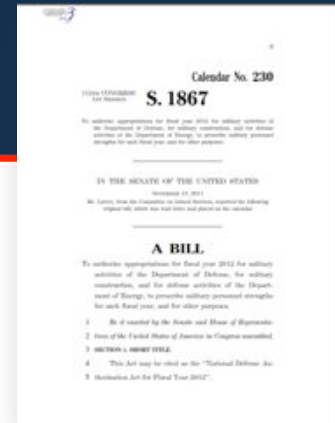
- Objective: Inform Agency Decision makers of the impacts to the Propulsion Industrial Base, due to potential SLS architecture decisions
- NIRPS and Aerospace Corporation to execute in conjunction with HEOMD, SLS (Engines and Booster Offices)
- Additional Partners: Defense Contracts Management Agency (DCMA), Defense Acquisition University (DAU) and Department of Commerce (DoC)
- Stakeholders: NASA, Office of the Secretary of Defense (OSD), US Navy Strategic Programs, USAF PEO, Space Launch
- Primary Tasks (Phase 1)
  - Evaluate the current and planned DoD expenditures for DDT&E, production, and operations for propulsion systems of current and future expendable launch vehicles
  - Provide subject matter expertise to provide an estimate of how SLS funding could affect the industrial base
  - Develop an approach to produce and analyze multi-layer supply chain maps for SLS rocket engines
  - SLS core uses existing RS-25Ds and (later) RS-25E expendable variants
  - Period of Performance(first phase): March 2013- August 2013 (approx. 20 weeks)

# Invigorate STEM Pipeline

## Academic Workshop

- Objective: to provide a forum to solicit input from the academic community on NIRPS
  - Progress to date
  - Strategic Plan
  - Engagement with the academic community
  - Revalidation of the grand challenges
- Location: UA Huntsville
- Date: In conjunction with the 7<sup>th</sup> Wernher von Braun Memorial Symposium 7-9 October 2013
- Membership: UA Huntsville will coordinate membership. Bob Fredrick and Tom Koshut will lead effort

# Develop Integrated S&T Plan



## NDA Sec. 1095

- (a) **SENSE OF THE CONGRESS.**-It is the sense of Congress that the sustainment of the solid rocket motor and liquid rocket engine industrial base is a national challenge that spans multiple departments and agencies of the Federal Government and requires the attention of the President.
- (b) **STRATEGY REQUIRED.**
- (1) **IN GENERAL.**-Not later than 180 days after the date of the enactment of this Act, the President shall transmit to the appropriate congressional committees a **national rocket propulsion strategy for the United States**, including-
- (A) **a description and assessment** of the effects to programs of the Department of Defense and intelligence community that rely on the solid rocket motor and liquid rocket engine industrial base caused by the end of the Space Shuttle program and termination of the Constellation program;
  - (B) **a description of the plans** of the President, the Secretary of Defense, the intelligence community, and the Administrator of the National Aeronautics and Space Administration to mitigate the impact of the end of the Space Shuttle program and termination of the Constellation program on the solid rocket motor and liquid rocket engine propulsion industrial base of the United States;
  - (C) **a consolidated plan** that outlines key decision points for the current and next-generation mission requirements of the United States with respect to tactical and strategic missiles, missile defense interceptors, targets, and satellite and human spaceflight launch vehicles;
  - (D) **options and recommendations** for synchronizing plans, programs, and budgets for research and development, procurement, operations, and workforce among the appropriate departments and agencies of the Federal Government to strengthen the solid rocket motor and liquid rocket engine propulsion industrial base of the United States; and
  - (E) any other relevant the President considers necessary

NIRPS assigned leadership responsibility by OSTP to address the  
National Rocket Propulsion Strategy

# NDAA Sec. 1095: Background

- Many previous studies and reports, and results are still valid. Six key needs are:
  - Competitiveness and resilience of the propulsion industrial base
  - An integrated science and technology plan
  - Better collaboration across agencies for propulsion systems development
  - Better and easier access to government facilities and expertise
  - Revitalized Science, Technology, Engineering and Mathematics (STEM) pipeline
  - Reduction of development and sustainment cost for propulsion components and systems
- Rocket propulsion is a key subsystem used to provide a necessary capability.
  - i.e. space launch, munitions delivery, etc.
- Rocket propulsion has evolved since the 1940s, but it remains a highly specialized field that relies significantly upon experience and heritage.
  - Some areas not fully understood and small perturbations have unintended results.
  - Aging of the workforce is a significant issue, with regard to maintaining safety and mission assurance.
  - Industry consolidation has reduced the number of companies serving the same market.

# NDA Sec. 1095 Accomplishments/Status

- **Team gathered and summarized data**
  - Defined Rocket Propulsion Industry Base and the Desired End State
  - Formed 6 integration categories
  - Drew on SRM and LRE 2011 Studies, Dept. of Commerce 2010 survey
- **Senior Steering Group (SSG) has held seven meetings with Inter Agency Task Team to provide guidance to the team**
- **Team held two Face-to-Face Workshops**
  - Army, Air Force, Navy, MDA, OSD, NASA, and FAA were all represented
- **Delivery of final report to OSTP completed January 2013**
- **Follow on action from OSTP, to evaluate courses of action and develop an recommended implementation plan**
- **Established Inter-Agency Task Team to develop implementation plan**
- **Performed additional study requested by OSTP on national altitude test capability**

# Develop integrated S&T plan

## Integrated High Payoff Rocket Propulsion Technology (IHDRPT) Steering Committee Meeting

**April 23-24 at Edwards AFB**

- Much interest in MSFC Additive Manufacturing and Structured Light for propulsion
- MSFC supporting AF Risk Reduction re. Hydrocarbon Boost Demo Program
- AF interest in F-1 GG testing
- AF Solid Rocket Modeling tool development useful to MSFC analysts
- AFRL Plasma Modeling work of interest to MSFC Electric Propulsion group
- AF Solid Propulsion Aging and Surveillance work applicable to NASA SRB work and composite case and CIF work on electrically controlled solids
- Several informal MSFC/AFRL discussions re. collaboration
- Planning meeting to discuss mapping NASA and IHDRPT Roadmaps
- Inputting NASA technology to IHDRPT GOTChA process

# Collaborate and Foster Access

- NIRPS will maintain relationships and awareness across the Government, industry and academia, to align available capacity with emerging demand
- Key activities
  - Develop interactive web based collaborative tool for use across the propulsion community
  - Support strategy and execution of the next JANNAF/NIRPS technical execution contract
  - Support ongoing development efforts across the propulsion community

# Reduce development, sustainment costs

## Coordinated AP Buy

- **Ammonium perchlorate (AP)** used by every armed service and many commercial firms
- **Historical decline** in demand for ammonium perchlorate, increasing costs and threatening remaining domestic supplier
- **NIRPS facilitated** coordination between government users in early 2012, stabilizing demand, production, and pricing.

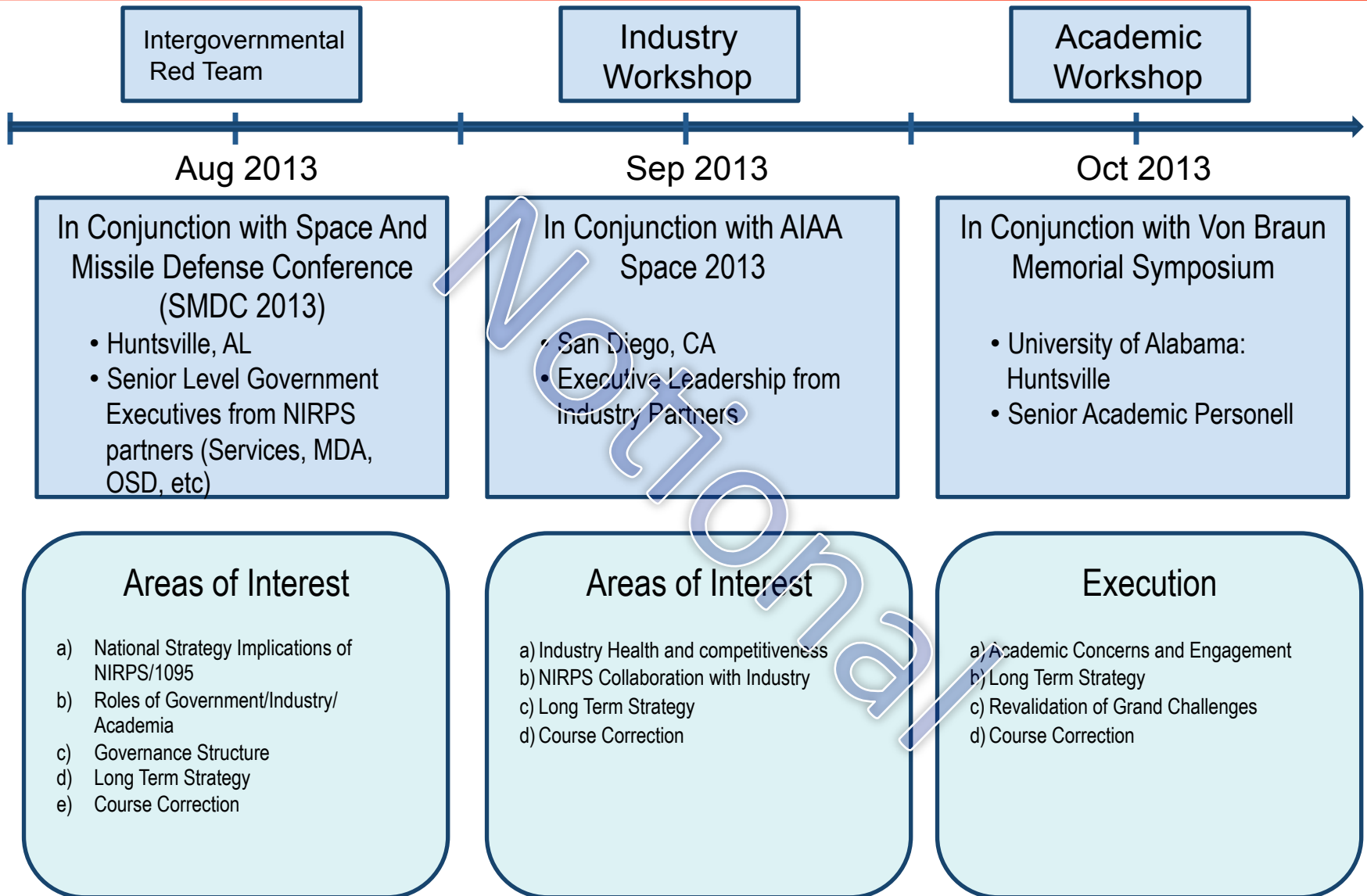


- **NIRPS AP Team presented** Technical Achievement Award from the Air, Space and Missile Defense Association Jan. 25, 2012

# NIRPS FY13 Goals

Grand Challenges	FY13 Goals	Team	Status
1. Support the Competitiveness and resilience of the industrial Base	1.1 Develop Supply Chain Analysis for SLS Architecture Decisions.	Stewardship	On Plan
	1.2 Develop Metrics to Determine Health of Industrial Base.	Stewardship	
2. Invigorate the STEM pipeline	2.1 Provide engineering students with practical experience utilizing propulsion design and analysis tools and methodologies.	Solutions Facilitator	On Plan
3. Develop and integrate a science and technology plan for propulsion systems	3.1 Use existing roadmaps to identify opportunities for collaborations and leveraging of complimentary activities.	Technology	
4. Reduce development and sustainment costs for missiles and rocket systems	4.1 Conduct a study/survey of low cost technology test beds and/or other methods for transitioning propulsion component /sub-system technologies through the TRL valley of death (TRL 4-6).	Technology	On Plan
5. Collaborate across agencies for missile and rocket propulsion system development	5.1 Develop initial community of interest capability.	Solutions Facilitator	
	5.2 Establish a Cross-Cutting Collaborative Solutions Team that executes tasks of cross community interest, stimulating potential follow-on collaborations.	Solutions Facilitator	
6. Foster access to facilities and expertise across Government, industry, and academia	6.1 Develop initial Propulsion Skills and Capabilities Directory & Web Tool.	Solutions Facilitator	
	6.2 Complete study of mechanisms for potential pass through process to ease access to cross government skills and capabilities.	Solutions Facilitator	Known Issues
Integrated Goals			
Integrated Goals	IG.1 Develop operational model defining management concepts, operating principles and framework, and high-level goals including a concept of management oversight for periodic evaluation.	Integrated	On Plan
	IG.2 Develop a comprehensive Strategic Communications Plan that addresses external and internal stakeholders, interactive websites, and outreach planning for public, STEM, and Agency/Industry engagement.	Integrated	
	IG.3 Establish a National Charter	Integrated	
	IG.4 NDAA 1095 Follow-on Activity	Integrated	
Have not started			
On Plan			
Known Issues			

# Looking Ahead: Reviews and Workshops



# Looking Forward: Challenges, Opportunities

***FY 2013 is a year of consolidation and execution***

***Pivot from organizational formulation to adding real value to the Propulsion Community***

## **Strategic Needs**

- Formalize agreements with other US Government Agencies
- Determine Interim and End States of NIRPS
- Respond and react to NDAA Sec. 1095 Outcomes
- Develop STEM Strategy and execution plan
- Effectively Communicate the value and accomplishments of NIRPS across the Agency, Government and Propulsion Community

## **Execution Priorities**

- Use NIRPS Metrics and DoC data to develop a “State of the Propulsion Industry” report/dashboard
- Develop Supply Chain Analysis capabilities to inform SLS and other major architecture decisions
- Complete initial Integrated Propulsion Science and Technology Roadmap in conjunction with IHP RPT (RP21)
- Build initial collaborative capability across the Propulsion Ecosystem and ease access to NASA facilities, skills and personnel

## **Challenges**

- Effective integration and Coordination with other Government Agencies
- Continued Active engagement with Industry and Academia
- Building an Efficient and Responsive Governance System for a growing Institute

# Summary

- **The NIRPS Mission**
- **Addressing the Grand Challenges**
- **Executing Tasks of National Importance**
- **Building our Capabilities**
- **Adding Value to the Propulsion Ecosystem**

# Follow us on the Web at:



<http://nirps.msfc.nasa.gov/home>

# Questions

